



Checklist of eels of Taiwan (orders Anguilliformes and Saccopharyngiformes): An update

HSUAN-CHING HO^{1,2,7}, DAVID G. SMITH³, KENNETH A. TIGHE⁵, YUSUKE HIBINO⁴ & JOHN E. MCCOSKER⁶

¹National Museum of Marine Biology & Aquarium, Pingtung, Taiwan

²Institute of Marine Biology, National Dong Hwa University, Pingtung, Taiwan

³Smithsonian Institution, Museum Support Center, Suitland, MD, U.S.A.

⁴Kitakyushu Museum of Natural History and Human History, Fukuoka, Japan

⁵Department of Vertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C., U.S.A.

⁶California Academy of Sciences, San Francisco, CA, U.S.A.

⁷Corresponding author. E-mail: ogcoho@gmail.com

Abstract

The eel fauna (orders Anguilliformes and Saccopharyngiformes) of Taiwan is increased to 14 families, 79 genera and 232 species. Previous studies (Ho *et al.*, 2015b, c) showed Taiwan had the highest diversity of eels in the world: this is further supported in the present updated work. Elsewhere in this volume, 16 species are newly described and 13 species are newly added to the Taiwanese ichthyofauna, mainly in the families Congridae and Synphobranchidae. In addition, one new genus and four new species are described from adjacent waters in the Pacific Ocean. A total of 58 new species of the two eel orders are described from Taiwan; 52 of them are valid, and 37 are only found in Taiwan. Four names previously recorded in Taiwan are described as new in present special issue and are removed from the fauna of Taiwan accordingly. This work provides a foundation for the study of eel diversity in Taiwan.

Key words: Biodiversity, Pisces, Anguilliformes, taxonomy, checklist, Taiwan

Introduction

Ho *et al.* (2015b, c) provided a historical account and an annotated checklist of the eels of Taiwan. One new genus, 14 new species and 30 new records were added, and previous records were evaluated, bringing the total eel fauna of Taiwan to 14 families and 207 species. While working on that publication, many other species were reserved for further study. Here we present an updated publication on the eels of Taiwan. The present volume contains 17 papers and describes 20 new species and documents many new findings (Table 1).

Among the new species, 16 are described from Taiwan and adjacent waters, and 13 are newly added to the ichthyofauna (two of them were reported in 2016 and 2017, respectively). In addition, one new genus and four new species are described from Hawaii, the Philippines, and Vietnam. In addition, at least ten unidentified or undescribed species await further study (Tables 2–3).

The main purpose of the present work is to describe the new species; to document new findings (mainly new records) since 2015; to provide supplementary data for the eel diversity in Taiwan, and their current status; and to provide a solid foundation for further studies.

Methods and materials

Methods used in this volume generally follow Ho *et al.* (2015 b, c), except where otherwise indicated. Institutional acronyms follow Eschmeyer *et al.* (2018). The geographic coordinates for localities can be found in Ebert *et al.*

(2013, table 5, fig. 1). References are not cited for the original descriptions, except for those mentioned in the text. In the following text, a plus sign preceding the species name indicates a new record for Taiwan. An asterisk indicates a newly described species.

TABLE 1. Statistical data of species counts of all eel families in Taiwan.

	Ho <i>et al.</i> (2015b, c)				This volume				Note
	Genera	Species	New species	New record	Genera	Species	New species	New record	
Order Anguilliformes									
Anguillidae	1	5			1	5			
Chlopsidae	3	3	1	1	3	3			
Colocongridae	1	2		1	1	2			
Congridae	16	30		9	18	44	9	5	Remove 1 species; 1 new genus and 3 new species from elsewhere
Derichthyidae	1	1		1	1	1			
Moringuidae	1	2			1	2			
Muraenesocidae	4	5			3	4			<i>Gavioliceps taiwanensis</i> is moved to Congridae
Muraenidae	13	71	1	1	13	74	1	2	Plus 1 new species from Vietnam
Nemichthyidae	2	2			2	2			
Nettastomatidae	3	7	2	1	3	7			
Ophichthidae	22	60	9	14	24	67	1	6	
Serrivomeridae	1	1			1	1			
Synphobranchidae	7	17	1	1	7	19	5		Remove 3 species
Order Saccopharyngiformes									
Eurypharyngidae	1	1		1	1	1			
Total	76	207	14	30	79	232	16	13	

The diversity of eel fauna in the world. According to the latest version *Catalog of Fishes* (Eschmeyer *et al.*, 2018), there are 20 families with ca. 974 valid species of eels (orders Anguilliformes and Saccopharyngiformes) in the world. The three most diverse families are the Ophichthidae (337 spp.), Muraenidae (207 spp.) and Congridae (200 spp.). A total 76 new species were described in last decade (2008–2018), mostly from the above mentioned three families, and this trend is not declining. Thus far, the greatest diversity of eels is found within the western Pacific Ocean, including Japan, Taiwan, Australia, Indonesia, and the Philippines (Froese & Pauly, 2018; our observation). With the effort of world experts, we have been able to uncover more forms in the western Pacific Ocean, especially from the deep sea, which has greatly increased our knowledge of eel diversity globally.

The diversity of eels of Taiwan. The eel fauna of Taiwan includes 14 out of the 20 known families in the world, with 232 out of ca. 996 species (23.3%, including the new species described in the present issue) in the orders Anguilliformes and Saccopharyngiformes (Eschmeyer *et al.*, 2018; present study), which makes it the most diverse in the world, although some countries may outrank Taiwan when their faunas have been fully studied. Table 1 provides statistical data of species counts in each family, including the newly added species, in Taiwan.

As noted above, 16 species are described as new to science, and three genera and 13 nominal species are newly added to the Taiwanese ichthyofauna in the present work. The ratio of new species described from Taiwan is very high. Fifty-eight were described from at least one type specimen collected from Taiwan. Of these, 52 out of 232 (22.4%) species are recognized as valid, whereas 6 are now considered invalid. At present, 37 species are found

only in Taiwan (Ho *et al.*, 2015b; present study), these are not recognized as endemic because they may be found in adjacent waters in the future.

Table 2 provides a list of all nominal species described from Taiwan and their current status, since Ho *et al.* (2015b, table 2). Table 3 provides a checklist of additional records or species with changed status in Taiwan, since Ho *et al.* (2015b, table 3). Included in the list are unidentified or undescribed species that need further work.

The contents of the present volume. This volume contains 17 papers, providing mostly new findings for the family Congridae, as well as families Muraenidae, Synphobranchidae and Ophichthidae.

In the Congridae, five genera in Taiwan and one genus in the western Pacific Ocean are reviewed: *Ariosoma* (8 species; 1 new species) (Smith *et al.*, 2018d); *Bathycongrus* (10 species; 5 new species) (Huang *et al.*, 2018; Smith & Ho, 2018a); *Bathyroconger* (6 species; 4 new species) (Smith *et al.*, 2018c); *Conger* (5 species) (Smith & Ho, 2018b); and *Macrocephenchelys* (3 species; 1 new species) (Lin *et al.*, 2018). In addition, Smith *et al.* (2018b) redescribes *Congrhynchus talabonoides* and Ho *et al.* (2018c) documents two new records. Smith (2018) also describes a new genus and species from the Philippines. Lin & Ho (2018) report the ontogenetic development of leptocephali of *Gavialiceps taiwanensis* collected from southwestern Taiwan.

In the Synphobranchidae, Ho *et al.* (2018b) describe a new species of *Synphobranchus* from Taiwan; Tighe *et al.* (2018) describe a new species of *Dysommia* from Taiwan and Japan; and Ho & Tighe (2018) describe three new species of *Dysommia* from Taiwan.

In the Ophichthidae, Chiu *et al.* (2018) review the snake eel genus *Lamnostoma* and recognize three species, including 1 new species; Ho *et al.* (2018a) document three new records and provide additional data on three previously described species.

In the Muraenidae, Smith *et al.* (2018a) describe one new species each from Taiwan and Vietnam, and add a new record for Taiwan.

All species mentioned above are documented in the present work, except for one genus and four new species which were described from elsewhere.

Update of annotated checklist of eels of Taiwan

Family Congridae

In the last volume (Ho *et al.*, 2015b, c), we presented 16 genera and 30 species from Taiwan. One of them, *Bathyroconger vicinus*, is described as a new species in this volume. In this volume we add 9 new species and 5 new records, which brings the total number of species to 17 genera and 45 species. Furthermore, several undescribed species in *Uroconger* will be dealt with in future work. A DNA barcoding approach (Smith, unpub. data) shows that there are at least five monophyletic clades present in what is currently recognized as *Uroconger lepturus* in Taiwan. However, with only a few available diagnostic characters, we hesitate to describe any of them as new at present.

+*Acromycter nezumi* (Asano, 1958)

Promyllantor nezumi Asano, 1958:198, 201, fig. 2 (type locality: off Owashi, Mie Prefecture, Japan).

Acromycter nezumi (Asano, 1958). Ho *et al.*, 2018c: this volume.

Remarks. Ho *et al.* (2018c) report the first specimen collected from southwestern Taiwan, as well as the South China Sea. This species appears to be rare in Taiwan.

+*Ariosoma dolichopterum* Karmovskaya, 2015

Ariosoma dolichopterum Karmovskaya, 2015:719 (Type locality: Coastal waters of Central Vietnam). Smith *et al.*, 2018e: this volume.

Remarks. The species was identified as *Ariosoma anago* by previous authors (Chen & Weng, 1967; Shen, 1998). Smith *et al.* (2018d) review the genus *Ariosoma* in Taiwan and verified its present identification.

TABLE 2. Additional records of eel species and these with changed status in Taiwan, after Ho *et al.* (2015b: table 2).

Original name	Current status/citation
Family Congridae	
<i>Acromycter nezumi</i> (Asano, 1958)	New record
<i>Ariosoma dolichopterum</i> Karmovskaya, 2015	New record
<i>A. emmae</i> Smith & Ho, this volume	New species
<i>Bathycongrus albimarginatus</i> Huang <i>et al.</i> , this volume	New species
<i>B. bimaculatus</i> Smith & Ho, this volume	New species
<i>B. bleekeri</i> Fowler, 1934	New record
<i>B. brunneus</i> Huang <i>et al.</i> , this volume	New species
<i>B. castlei</i> Smith & Ho, this volume	New species
<i>B. graciliceps</i> Smith & Ho, this volume	New species
<i>B. macroporis</i> (Kotthaus, 1968)	New record
<i>Bathyuroconger albus</i> Smith <i>et al.</i> , this volume	New species; <i>B. vicinus</i> is a misidentification
<i>B. dolichosomus</i> Smith <i>et al.</i> , this volume	New species
<i>Conger philippinus</i> Kanazawa, 1958	New record
<i>Macrocephenchelys nigriventris</i> Lin <i>et al.</i> , this volume	New species
<i>Uroconger</i> sp. 1	Unidentified species
<i>Uroconger</i> sp. 2	Unidentified species
<i>Uroconger</i> sp. 3	Unidentified species
<i>Uroconger</i> sp. 4	Unidentified species
Family Muraenidae	
<i>Gymnothorax angusticauda</i> (Weber & de Beaufort, 1916)	New record
<i>G. enigmaticus</i> McCosker & Randall, 1982	Huang <i>et al.</i> , 2017; present study
<i>G. pseudoprolatus</i> Smith <i>et al.</i> , 2018	New species
Family Ophichthidae	
<i>Allips concolor</i> McCosker, 1972	New record
<i>Apterichtus hatoakai</i> Hibino <i>et al.</i> , 2014	Ho, 2016
<i>A. moseri</i> (Jordan & Snyder, 1901)	New record
<i>Neenchelys daedalus</i> McCosker, 1982	New record
<i>Ophichthus retrodorsalis</i> Liu <i>et al.</i> , 2010	New record
<i>Ophichthus</i> sp. 1	Unidentified species
<i>Ophichthus</i> sp. 2	Unidentified species
Family Synphobranchidae	
<i>Dysomma formosa</i> Ho & Tighe, this volume	New species
<i>D. robinsorum</i> Ho & Tighe, this volume	New species; <i>D. goslinei</i> is a misidentification
<i>D. brachygnathos</i> Ho & Tighe, this volume	New species
<i>Dysomma</i> sp. 1	Unidentified species
<i>Dysommia orientalis</i> Tighe <i>et al.</i> , this volume	New species; <i>D. rugosa</i> is a misidentification
<i>Synphobranchus oligolepis</i> Ho <i>et al.</i> , this volume	New species
Family Nettastomatidae	
<i>Saurenehelys</i> sp. 1	Undescribed species
<i>Saurenehelys</i> sp. 2	Undescribed species
<i>Saurenehelys</i> sp. 3	Undescribed species
<i>Facciolella</i> sp. 1	Undescribed species
<i>Facciolella</i> sp. 2	Undescribed species

TABLE 3. List of all new genera and species described in Taiwan and their current status, after Ho *et al.* (2015b:table 3).

Original name	Current status
Family Anguillidae	
<i>Anguilla remifera</i> Jordan & Evermann, 1902	= <i>Anguilla japonica</i>
Family Chlopsidae	
<i>Chlopsis nanhaiensis</i> Tighe <i>et al.</i> , 2015	Valid, Taiwan only
Family Muraenidae	
<i>Cirrimaxilla</i> Chen & Shao, 1995	Valid
<i>Cirrimaxilla formosa</i> Chen & Shao, 1995	Valid
<i>Gymnothorax leucostigma</i> Jordan & Richardson, 1909	= <i>Gymnothorax prionodon</i>
<i>G. melanosomatus</i> Loh <i>et al.</i> , 2011	Valid, Taiwan only
<i>G. neglectus</i> Tanaka, 1911	Valid
<i>G. niphostigmus</i> Chen <i>et al.</i> , 1996	Valid, Taiwan only
<i>G. pescadoris</i> Jordan & Evermann, 1902	= <i>Gymnothorax isingteena</i>
<i>G. prolatus</i> Sasaki & Amaoka, 1991	Valid
<i>G. pseudomelanosomatus</i> Loh <i>et al.</i> , 2015	Valid, Taiwan only
<i>G. pseudoprolatus</i> Smith <i>et al.</i> , 2018	New species, Taiwan only
<i>G. shaoi</i> Chen & Loh, 2007	Valid, Taiwan only
<i>G. taiwanensis</i> Chen <i>et al.</i> , 2008	Valid, Taiwan only
<i>Uropterygius oligospondylus</i> Chen <i>et al.</i> , 2008	Valid
Family Synophbranchidae	
<i>Dysomma brachygnathos</i> Tighe & Ho, this volume	Valid, Taiwan only
<i>D. formosa</i> Ho & Tighe, this volume	Valid, Taiwan only
<i>D. longirostrum</i> Chen & Mok, 2001	Valid
<i>D. melanurum</i> Chen & Weng, 1967	Valid, Taiwan only
<i>D. opisthoproctus</i> Chen & Mok, 1995	Valid, Taiwan only
<i>D. robinsorum</i> Ho <i>et al.</i> , this volume	Valid, Taiwan only
<i>D. taiwanense</i> Ho <i>et al.</i> , 2015	Valid; also from Japan
<i>Dysommia orientalis</i> Tighe <i>et al.</i> , this volume	Valid, Taiwan only
<i>Meadia roseni</i> Mok <i>et al.</i> , 1991	Valid, Taiwan only
<i>Synaphobranchus oligolepis</i> Ho <i>et al.</i> , this volume	Valid, Taiwan only
Family Ophichthidae	
<i>Pylorobranchus</i> McCosker & Chen 2012	Valid
<i>Sympenchelys</i> Hibino <i>et al.</i> , 2015	Valid, Taiwan only
<i>Brachysomophis longipinnis</i> McCosker & Randall, 2001	Valid, Taiwan only
<i>Cirrhaecula macdowellii</i> McCosker & Randall, 1993	Valid, Taiwan only
<i>Echelus pachyrhynchus</i> McCosker & Ho, this volume	Valid, Taiwan only
<i>Lamnostoma taiwanense</i> Chiu <i>et al.</i> , this volume	Valid, Taiwan only
<i>Myrophis cheni</i> Chen & Weng, 1967	Valid as <i>Neenchelys cheni</i>
<i>Neenchelys diaphora</i> Ho <i>et al.</i> , 2015	Valid, Taiwan only
<i>N. gracilis</i> Ho & Loh, 2015	Valid, Taiwan only
<i>N. mccoskeri</i> Hibino <i>et al.</i> , 2012	Valid
<i>N. pelagica</i> Ho <i>et al.</i> , 2015	Valid, Taiwan only
<i>N. similis</i> Ho <i>et al.</i> , 2015	Valid

.....continued on the next page

TABLE 3. (Continued)

Original name	Current status
<i>Ophichthus aphotistos</i> McCosker & Chen, 2000	Valid
<i>O. bicolor</i> McCosker & Ho, 2015	Valid, Taiwan only
<i>O. evermanni</i> Jordan & Richardson, 1909	= <i>Ophichthus lithinus</i>
<i>O. shaoi</i> McCosker & Ho, 2015	Valid, Taiwan only
<i>Pylorobranchus hoi</i> McCosker <i>et al.</i> , 2012	Valid, Taiwan only
<i>Sympenchelys taiwanensis</i> Hibino <i>et al.</i> , 2015	Valid, Taiwan only
<i>Xyrias chioui</i> McCosker <i>et al.</i> , 2009	Valid, Taiwan only
Family Congridae	
<i>Ariosoma emmae</i> Smith & Ho, 2018	Valid, Taiwan only
<i>A. nancyae</i> Shen, 1998	= <i>Ariosoma fasciatum</i>
<i>Bathycongrus albimarginatus</i> Huang <i>et al.</i> , this volume	Valid, Taiwan only
<i>B. bimaculatus</i> Smith & Ho, this volume	Valid, Taiwan only
<i>B. brunneus</i> Huang <i>et al.</i> , this volume	Valid, Taiwan only
<i>B. castlei</i> Smith & Ho, this volume	Valid, Taiwan only
<i>B. graciliceps</i> Smith & Ho, this volume	Valid, Taiwan only
<i>Bathyuroconger albus</i> Smith <i>et al.</i> , this volume	Valid, Taiwan only
<i>B. dolichosomus</i> Smith <i>et al.</i> , this volume	Valid, Taiwan only
<i>Chlopsis taiwanensis</i> Chen & Weng, 1967	Valid as <i>Gavialiceps taiwanensis</i> , Taiwan only
<i>Gorgasia taiwanensis</i> Shao, 1990	Valid
<i>Leptocephalus ectenurus</i> Jordan & Richardson, 1909	Valid as <i>Rhynchoconger ectenurus</i>
<i>Macrocephenchelys nigriventris</i> Lin <i>et al.</i> , this volume	Valid, Taiwan only
<i>Rhynchoconger brachuata</i> Chu & Chen, 1958	= <i>Rhynchoconger ectenurus</i>
<i>R. brevirostris</i> Chen & Weng, 1967	Valid as <i>Macrocephenchelys brevirostris</i>
Family Nettastomatidae	
<i>Nettenchelys proxima</i> Smith <i>et al.</i> , 2015	Valid
<i>Saurenychelys gigas</i> Lin <i>et al.</i> , 2015	Valid

****Ariosoma emmae* Smith & Ho, this volume**

Ariosoma emmae Smith & Ho in Smith *et al.*, 2018d: this volume (type locality: Ke-tzu-liao, Kaohsiung, southwestern Taiwan).

Remarks. This species was mixed with the specimens previously identified as *A. dolichopterum*. Morphological and genetic analyses recognize it as a distinct species.

+*Bathycongrus bleekeri* Fowler, 1934

Bathycongrus bleekeri Fowler, 1934:272 (Type locality: Utara Pt., Bongo Island, southern Mindanao, Philippines, 7°22'12"N, 124°12'15"E, depth 28 fathoms). Castle & Smith, 1999:993. Karmovskaya & Smith, 2008:30. Smith & Ho, 2018a: this volume.

Remarks. Several specimens were collected recently from off Dong-gang, southwestern Taiwan. The species was redescribed by Karmovskaya & Smith (2008) based on two specimens. Our specimens represent the first record from Taiwan, as well as the first record outside the type locality (Philippines).

****Bathycongrus albimarginatus* Huang, Smith, Chang & Chen, this volume**

Bathycongrus albimarginatus Huang, Smith, Chang & Chen in Huang *et al.*, 2018: this volume (type locality: Wushibi, Changbin, Taitung, eastern Taiwan).

Remarks. Newly described in this volume by Huang *et al.* (2018). The species is only found in eastern Taiwan off Taitung; collected by hook and line.

****Bathycongrus bimaculatus* Smith & Ho, this volume**

Bathycongrus bimaculatus Smith & Ho, 2018a: this volume (type locality: off Dong-gang, Pingtung, southwestern Taiwan, South China Sea, bottom trawl, ca. 300 m).

Remarks. Newly described in this volume by Smith & Ho (2018a). This species is only found in southwestern Taiwan off Dong-gang; collected by bottom trawl.

****Bathycongrus brunneus* Huang, Ho & Chen, this volume**

Bathycongrus brunneus Huang, Ho & Chen in Huang *et al.*, 2018: this volume (type locality: Changbin, Taitung, eastern Taiwan).

Remarks. Newly described in this volume by Huang *et al.* (2018). The species is only found in eastern Taiwan off Taitung; collected by hook and line.

****Bathycongrus castlei* Smith & Ho, this volume**

Bathycongrus castlei Smith & Ho, 2018a: this volume (type locality: Nan-fang-ao, Yilan, NE Taiwan, northwestern Pacific Ocean).

Remarks. Newly described in this volume by Smith & Ho (2018a). This species is only found in northeastern Taiwan; collected by bottom trawl.

****Bathycongrus graciliceps* Smith & Ho, this volume**

Bathycongrus graciliceps Smith & Ho, 2018a: this volume (type locality: Daxi, Yilan, NE Taiwan, northwestern Pacific Ocean).

Remarks. Newly described in this volume by Smith & Ho (2018a), based on two specimens collected from northeastern and southwestern Taiwan, respectively.

****Bathyuroconger albus* Smith, Ho & Tashiro, this volume**

Bathyuroconger vicinus (not of Vaillant): Shao *et al.*, 2008:239. Ho *et al.*, 2015b: 146.

Bathyuroconger albus Smith, Ho & Tashiro, 2018c: this volume (type locality: Daxi, Yilan, northeastern Taiwan, northwestern Pacific Ocean)

Remarks. This species has long been identified as *Bathyuroconger vicinus*, which was originally described from the Atlantic Ocean. After a detailed comparison, Smith *et al.* (2018c) found four new species present in this genus, which brings the total number of species in the genus to six. Besides the two new species described from Taiwan, two other species are described here from Hawaii and the Philippines (the latter from the type series of *B. parvibranchialis*).

****Bathyroconger dolichosomus* Smith, Ho & Tashiro, this volume**

Bathyroconger dolichosomus Smith, Ho & Tashiro, 2018c: this volume (type locality: Daxi fishing port, Yilan, NE Taiwan, northwestern Pacific Ocean).

Remarks. This is one of two new species described from Taiwan. This species is known only from the holotype. However, with a distinctively long trunk, it can be easily separated from all known congeners.

+*Conger philippinus* Kanazawa, 1958

Conger philippinus Kanazawa, 1958:255, pl. 1, fig. K (type locality: Market in Cebu, Philippines). Smith & Ho, 2018b: this volume.

Remarks. Several specimens were collected recently that represent the first record from Taiwan, as well the first record outside the type locality after its first description. Ho *et al.* (2015c) recognized four species of *Conger*: *C. cinereus* Rüppell, *C. jordani* Kanazawa, *C. macrocephalus* Kanazawa, and *C. myriaster* (Brevoort). Smith & Ho (2018b) provide detailed information of all these *Conger* species. Specimens were also collected from Vietnam.

****Macrocephenchelys nigriventris* Lin, Shao & Smith, this volume**

Macrocephenchelys nigriventris Lin, Shao & Smith, 2018: this volume. (type locality: Nan-fang-ao, Yilan, northeastern Taiwan).

Remarks. Newly described in this volume by Lin *et al.* (2018). This species is commonly collected from off northeastern and southwestern Taiwan, by bottom trawl.

Family Muraenidae

In the last volume, Ho *et al.* (2015b, c) listed 13 genera and 71 species in this family, based on previously work. A new species and two new records are added here. The family Muraenidae in Taiwan is presently represented by 13 genera and 74 species. A few unidentified or undescribed forms await future investigation.

***Gymnothorax enigmaticus* McCosker & Randall, 1982**

Gymnothorax enigmaticus McCosker & Randall, 1982:18, figs. 1, 4 (type locality: off Ngatchab Beach, Angaur Island, Palau Islands, Western Caroline Islands, western Pacific). Smith, 2012:14. Huang *et al.*, 2017:90.

Remarks. Huang *et al.* (2017) reported the first record of this species for Taiwan, based on one specimen collected from off Jihui, eastern Taiwan. Two specimens were subsequently collected from Kenting, off southern Taiwan and Green Island (Ludao) off southeastern Taiwan by J.-F Huang. The species is widespread in the Indo-west Pacific Ocean.

+*Gymnothorax angusticauda* (Weber & de Beaufort, 1916)

Muraena (Priodonophis) angusticauda Weber & de Beaufort, 1916:389, fig. 388 (type locality: Near Supiori, Schouten Islands, Papua, Indonesia, western Pacific). Smith *et al.*, 2018a: this volume.

Remarks. Smith *et al.* (2018a) report several specimens collected from off Dong-gang and Ke-tzo-liao of southwestern Taiwan. This species is usually collected from quite shallow waters on sand and mud bottoms. Our

specimens were collected by bottom trawl at around 30–100 m. It appears to be an uncommon species rarely seen, despite many intensive collections from the fish landing places.

****Gymnothorax pseudoprolatus* Smith, Hibino & Ho, this volume**

Gymnothorax pseudoprolatus Smith, Hibino & Ho, 2018a: this volume (type locality: Dong-gang, Pingtung, southwestern Taiwan).

Remarks. The holotype and only known specimen was collected from southwestern Taiwan, off Dong-gang.

Family Ophichthidae

In the previous volume, Ho *et al.* (2015b, c) listed 22 genera and 60 species in this family. In the present work, one new species and six new records are added. The total diversity of snake eels now includes 24 genera and 67. Some other unidentified or undescribed forms remain to be examined.

+*Allips concolor* McCosker, 1972

Allips concolor McCosker, 1972:117, figs. 4–5 (type locality: Ko Phi Island, Myanmar). Ho *et al.*, 2018a: this volume.

Remarks. A single specimen was collected from southwestern Taiwan off Dong-gang, representing the first record of this species from Taiwan and the South China Sea.

***Apterichtus hatookai* Hibino, Shibata & Kimura, 2014**

Apterichtus hatookai Hibino, Shibata & Kimura 2014:318, fig. 1 (type locality: Morode, Ainan, Minami-uwa, Ehime Prefecture, Japan, 4–5 m). Ho, 2016:28.

Remarks. Ho (2016) reported two specimens collected from southwestern Taiwan off Ke-tzu-liao, which represent the first record of this species from Taiwan.

+*Apterichtus moseri* (Jordan & Snyder, 1901)

Sphagebranchus moseri Jordan & Snyder, 1901:864, fig. 14 (type locality: Suruga Bay, off Namazu, Japan, depth 63 fathoms [115 m]).

Apterichtus moseri (Jordan & Snyder, 1901): McCosker & Hibino, 2015:70. Ho *et al.*, 2018a: this volume.

Remarks. A specimen was collected from southwestern Taiwan. The species was previously recorded from only two localities, Japan (type locality) and the Marquesas Islands, but the latter is probably based on misidentification.

+*Lamnostoma polyophthalmum* (Bleeker, 1853)

Dalophis polyophthalmus Bleeker, 1853:299 (type locality: Priaman, Indonesia).

Lamnostoma polyophthalmum: Chiu *et al.*, 2018: this volume.

Remarks. Chiu *et al.* (2018) review the genus in Taiwan, and described one new species and one new record from Taiwan.

****Lamnostoma taiwanense* Chiu, Huang & Shao, this volume**

Lamnostoma taiwanense Chiu, Huang & Shao in Chiu, Huang, Shao & Chen, 2018: this volume (type locality: Juan-wei, Yilan, northeastern Taiwan).

Remarks. Newly described in Taiwan by Chiu *et al.* (2018); only found in river mouths of northeastern Taiwan.

+*Neenchelys daedalus* McCosker, 1982

Neenchelys daedalus McCosker, 1982:63, figs. 4-5 (type locality: Astrolabe Bay, south of Madang, Papua New Guinea). Ho *et al.*, 2013:7. Ho *et al.*, 2018a: this volume.

Remarks. Two specimens were newly collected from southern Taiwan, which represent only the second record of this species since it was first described. This species appears to be rare, as only four specimens are known to science.

+*Ophichthus retrodorsalis* Liu, Tang & Zhang, 2010

Ophichthus retrodorsalis Liu, Tang & Zhang, 2010:332, fig. 191 (type locality: Fuzhou City, Fujian Province, southeastern China).

Remarks. Previously known only from the holotype collected from southeastern China. A specimen (NMMB-P28996) was collected from southwestern Taiwan off Ke-tzu-liao recently. The species is identified as *Ophichthus retrodorsalis* by having dorsal-fin origin about 1.5 pectoral-fin length behind tip of fin; two small barbels on upper jaw; two preopercular pores; four supraorbital pores; 3–4 rows of granular teeth on vomer and jaws; and its coloration. However, there is some difference in the arrangement of jaw teeth, and more specimens are needed to document the variation in this species. The granular teeth on the jaws may also indicate that this is a species of *Pisodonophis*, rather than *Ophichthus*, as presently classified.

Family Synphobranchidae

Ho *et al.* (2015c) listed 7 genera and 17 species from Taiwan. In the present study, two of these are described as new, and the presence of *Synphobranchus affinis* in Taiwan has become doubtful because of a lack of voucher specimens. Here we add two more new species of *Dysomma*, bringing the total species of the family to 21 or 22 (the latter including *S. affinis*). There are still unidentified or undescribed species awaiting further investigation.

****Dysomma brachygnathos* Ho & Tighe, this volume**

Dysomma brachygnathos Ho & Tighe, 2018: this volume (type locality: Dong-gang, Pingtung, southwestern Taiwan)

Remarks. Newly described from Taiwan in Ho & Tighe (2018). This species is represented only by the two type specimens.

****Dysomma formosa* Ho & Tighe, this volume**

Dysomma formosa Ho & Tighe, 2018: this volume (type locality: Dong-gang, southwestern Taiwan).

Remarks. This species was commonly collected together with *Dysomma taiwanense* and *D. anguillare* in

southwestern Taiwan. However, with several distinct characters, it is now recognized as a new species. Ho & Tighe (2018) examined recently collected specimens and provided a detailed comparison of these species. .

****Dysomma robinsorum* Ho & Tighe, this volume**

Dysomma goslinei (not of Robins & Robins): Chen & Mok, 2001:79. Ho *et al.*, 2015a:94.

Dysomma robinsorum Ho & Tighe, 2018: this volume (type locality: Dong-gang, southern Taiwan).

Remarks. This species was previously recognized in Taiwan as *Dysomma goslinei*. However, four specimens collected from Taiwan have distinctly fewer total vertebrae and hence are described as new by Ho & Tighe (2018).

****Dysommia orientalis* Tighe, Ho & Hatooka, this volume**

Dysommia rugosa (not of Ginsburg): Chen & Mok, 2001:79. Ho *et al.*, 2015a:100.

Dysommia orientalis Tighe, Ho & Hatooka, 2018: this volume (type locality: Dong-gang, southern Taiwan).

Remarks. The species has long been identified as *Dysommia rugosa* in Taiwan and Japan. Tighe *et al.* (2018) compared the morphological and genetic features and confirm that the specimens collected from Taiwan and Japan are different from the Atlantic population, and a new name is given.

****Synaphobranchus oligolepis* Ho, Hong & Chen, this volume**

Synaphobranchus oligolepis Ho, Hong & Chen, 2018b: this volume (type locality: Dong-gang, Pingtung, southwestern Taiwan).

Remarks. This species initially was confused with *Synaphobranchus affinis* due to the position of origin of dorsal fin. However, the large naked areas on anterior portion of body readily separate it from *S. affinis*.

Family Nettastomatidae

No new species were added to this volume. However, we found there are at least three undescribed species of *Saurenhelys*, and two undescribed species of *Facciolella* collected from Taiwan in the collections. These species are being described and will be published in the near future.

Acknowledgements

We are grateful for the support of the National Museum of Marine Biology & Aquarium, Pingtung, Taiwan. We are also grateful to the Smithsonian Institution for access to its fish collections and facilities.

References

- Asano, H. (1958) Studies on the conger eels of Japan. II. Description of two new fishes referable to the genera *Rhynchocyba* and *Promyllantor*. *Dobutsugaku Zasshi* = *Zoological Magazine Tokyo*, 67 (7), 197–201. [in Japanese]
Bleeker, P. (1853) Diagnostische beschrijvingen van nieuwe of weinig bekende vischsoorten van Sumatra. Tiental V-X. *Natuurkundig Tijdschrift voor Nederlandsch Indië*, 4 (2), 243–302.
Castle, P.H.J. & Smith, D.G. (1999) A reassessment of the eels of the genus *Bathycongrus* in the Indo-west Pacific. *Journal of Fish Biology*, 54 (5), 973–995.
Chen, J.T.F. & Weng, H.T.C. (1967) A review of the apodal fishes of Taiwan. *Biological Bulletin Tunghai University*

- Chen, Y.-Y. & Mok, H.-K. (2001) A new synphobranchid eel, *Dysomma longirostrum* (Anguilliformes: Synphobranchidae), from the northeastern coast of Taiwan. *Zoological Studies*, 40 (2), 79–83.
- Chiu, Y.-C., Shao, K.-T., Huang, S.-P. & Chen, H.-M. (2018) The freshwater snake eel genus *Lamnostoma* (Anguilliformes: Ophichthidae) in Taiwan, with description of a new species. *Zootaxa*, 4454 (1), 18–32.
<https://doi.org/10.11646/zootaxa.4454.1.4>
- Ebert, D.A., White, W.T., Ho, H.-C., Last, P.R., Nakaya, K., Séret, B., Straube, N., Naylor, G.J.P. & de Carvalho, M.R.C. (2013) An annotated checklist of the chondrichthyans of Taiwan. *Zootaxa*, 3752 (1), 279–386.
- Eschmeyer, W.N., Fricke, R. & van der Laan, R. (eds). (2018) Catalog of Fishes: genera, species, references. (<http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>). Electronic version accessed 01 May 2018.
- Fowler, H.W. (1934) Descriptions of new fishes obtained 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. *Proceedings of the Academy of Natural Sciences of Philadelphia*, 85, 233–367.
- Froese, R. & Pauly, D. (Eds.) (2018) FishBase. World Wide Web electronic publication. Available from: <http://www.fishbase.org> (accessed May 2018)
- Hibino, Y., Shibata, J.-Y. & Kimura, S. (2014) Description of a new snake eel, *Apterichtus hatookai* sp. nov. (Anguilliformes: Ophichthidae), from the Pacific coast of Japan. *Ichthyological Research*, 317–321, 1–5.
- Ho, H.-C. (2016) New record of the finless eel *Apterichtus hatookai* from Taiwan (Anguilliformes: Ophichthidae: Ophichthinae). *Platax*, 13, 27–31.
- Ho, H.-C. & Tighe, K.A. (2018) Three new species of the cutthroat eel genus *Dysomma*, with comments on the variation of *D. taiwanense* (Anguilliformes: Synphobranchidae). *Zootaxa*, 4454 (1), 52–67.
<https://doi.org/10.11646/zootaxa.4454.1.7>
- Ho, H.-C., Hibino, Y. & Huang, J.-F. (2018a) Note on rare snake eels (Anguilliformes: Ophichthidae) and additional data on three *Neenchelys* recently described from Taiwan. *Zootaxa*, 4454 (1), 200–214.
<https://doi.org/10.11646/zootaxa.4454.1.16>
- Ho, H.-C., Hong, W.-C. & Chen, H.-M. (2018b) A new cutthroat eel of the genus *Synphobranchus* (Anguilliformes: Synphobranchidae) from Taiwan. *Zootaxa*, 4454 (1), 68–77.
<https://doi.org/10.11646/zootaxa.4454.1.8>
- Ho, H.-C., McCosker, J.E. & Smith, D.G. (2013) Revision of the worm eel genus *Neenchelys* (Ophichthidae; Myrophinae), with descriptions of three new species from the western Pacific Ocean. *Zoological Studies*, 52, 1–20.
- Ho, H.-C., Smith, D.G. & Huang, J.-F. (2018c) Notes on two rare conger eel species (Anguilliformes: Congridae) found in Taiwanese waters. *Zootaxa*, 0000 (0), 00–00.
- Ho, H.-C., Smith, D.G. & Tighe, K.A. (2015a) Review of the arrowtooth eel genera *Dysomma* and *Dysommia* in Taiwan, with the description of a new species (Anguilliformes: Synphobranchidae: Ilyophinae). *Zootaxa*, 4060 (1), 86–104.
- Ho, H.-C., McCosker, J.E., Smith, D.G. & Shao, K.-T. (2015b) Introduction to the systematics and biodiversity of eels (orders Anguilliformes and Saccopharyngiformes) of Taiwan. *Zootaxa*, 4060 (1), 5–18.
- Ho, H.-C., Smith, D.G., McCosker, J.E., Hibino, Y., Loh, K.-H., Tighe, K.A., & Shao, K.-T. (2015c) Annotated checklist of eels (orders Anguilliformes and Saccopharyngiformes) from Taiwan. *Zootaxa*, 4060 (1), 140–189.
- Huang, J.-F., Ho, H.-C., Chang, Y.-S., Smith, D.G. & Chen, H.-M. (2018) Two new species of the conger eel genus *Bathycongrus* (Anguilliformes: Congridae) from Taiwan. *Zootaxa*, 4454 (1), 107–117.
<https://doi.org/10.11646/zootaxa.4454.1.11>
- Huang, W.-C., Shiao, J.-C. & Liao, T.-Y. (2017) New record of the enigmatic moray *Gymnothorax enigmaticus* McCosker and Randall, 1982 (Anguilliformes: Muraenidae) from Taiwan. *Platax*, 14, 89–95.
- Jordan, D.S. & Snyder, J.O. (1901) A review of the apodal fishes or eels of Japan, with descriptions of nineteen new species. *Proceedings of the United States National Museum*, 23 (1239), 837–890.
- Kanazawa, R.H. (1958) A revision of the eels of the genus *Conger* with descriptions of four new species. *Proceedings of the United States National Museum*, 108 (3400), 219–267.
- Karmovskaya, E.S. (2015) New species of the genus *Ariosoma*, *A. dolichopterum* (Bathymyrinae), from the waters of Central Vietnam. *Voprosy Ikhtologii*, 55 (6), 719–723. [In Russian. English translation in *Journal of Ichthyology*, 55 (6), 906–910.]
- Karmovskaya, E.S. & Smith, D.G. (2008) *Bathycongrus trimaculatus*, a new congrid eel (Teleostei: Anguilliformes) from the southwestern Pacific, with a redescription of *Bathycongrus bleekeri* Fowler. *Zootaxa*, 1943, 26–36.
- Lin, J.-T. & Ho, H.-C. (2018) Morphological and molecular identification of the leptocephali of Taiwanese duckbill conger, *Gavialiceps taiwanensis* (Chen & Weng, 1967) (Family Congridae). *Zootaxa*, 4454 (1), 215–227.
<https://doi.org/10.11646/zootaxa.4454.1.17>
- Lin, J., Shao, K.-T., Smith, D.G. (2018) The eel genus *Macrocephenchelys* (Anguilliformes: Congridae) in Taiwan, with description of a new species. *Zootaxa*, 4454 (1), 186–199.
<https://doi.org/10.11646/zootaxa.4454.1.15>
- Liu, D., Tang, W. & Zhang, C. (2010) *Ophichthus retrodorsalis* sp. nov. In: Zhang, C. (Ed.), *Fauna Sinica: Osteichthyes: Anguilliformes and Notacanthiformes*. Science Press, Beijing, 332–333.
- McCosker, J.E. (1972) Two new genera and two new species of western Pacific snake-eels (Apodes: Ophichthidae). *Proceedings of the California Academy of Sciences (Series 4)*, 39 (10), 111–119.

- McCosker, J.E. (1982) A new genus and two new species of remarkable Pacific worm eels (Ophichthidae, subfamily Myrophinae). *Proceedings of the California Academy of Sciences (Series 4)*, 43 (5), 59–66.
- McCosker, J.E. & Hibino, Y. (2015) A review of the finless snake eels of the genus *Apterichtus* (Anguilliformes: Ophichthidae), with the description of five new species. *Zootaxa*, 3941 (1), 49–78.
- McCosker, J.E. & Randall, J.E. (1982) Synonymies of Indian Ocean eels, with the description of *Gymnothorax enigmaticus*, a moray previously known as *G. ruppeli*. *Proceedings of the California Academy of Sciences (Series 4)*, 43 (2), 17–24.
- Shao, K.-T., Ho, H.-C., Lin, P.-L., Lee, P.-F., Lee, M.-Y., Tsai, C.-Y., Liao, Y.-C. & Lin, Y.-C. (2008) A checklist of the fishes of southern Taiwan, Northern South China Sea. *Raffles Bulletin of Zoology*, Supplement 19, 233–271.
- Shen, S.-C. (1998) A review of congrid eels of the genus *Ariosoma* from Taiwan, with description of a new species. *Zoological Studies*, 37 (1), 7–12.
- Smith, D.G. (2012) A checklist of the moray eels of the world (Teleostei: Anguilliformes: Muraenidae). *Zootaxa*, 3474, 1–64.
- Smith, D.G. (2018) A new genus and species of congrid eel from the Philippines (Anguilliformes: Congridae: Bathymyrinae). *Zootaxa*, 4454 (1), 78–83.
<https://doi.org/10.11646/zootaxa.4454.1.9>
- Smith, D.G. & Ho, H.-C. (2018a) The congrid eel genus *Bathycongrus* of Taiwan, with descriptions of three new species (Anguilliformes: Congridae). *Zootaxa*, 4454 (1), 118–146.
<https://doi.org/10.11646/zootaxa.4454.1.12>
- Smith, D.G. & Ho, H.-C. (2018b) Review of the congrid eel genus *Conger* (Anguilliformes: Congridae) in Taiwan. *Zootaxa*, 4454 (1), 168–185.
<https://doi.org/10.11646/zootaxa.4454.1.14>
- Smith, D.G. Hibino, Y. & Ho, H.-C. (2018a) Two new elongate unpatterned moray eels from Taiwan and Vietnam, with notes on two congeners (Anguilliformes: Muraenidae). *Zootaxa*, 4454 (1), 33–42.
<https://doi.org/10.11646/zootaxa.4454.1.5>
- Smith, D.G., Ho, H.-C., Sumod, K.S. (2018b) Redescription of *Congrhynchus talabonoides* Fowler, 1934 (Anguilliformes: Congridae) based on specimens collected from the Philippines, Taiwan and India. *Zootaxa*, 4454 (1), 228–232.
<https://doi.org/10.11646/zootaxa.4454.1.18>
- Smith, D.G. Ho, H.-C. & Tashiro, F. (2018c) Eels of the genus *Bathyuroconger* in the northwestern Pacific, with description of four new species (Anguilliformes: Congridae). *Zootaxa*, 4454 (1), 147–167.
<https://doi.org/10.11646/zootaxa.4454.1.13>
- Smith, D.G. & Ho, H.-C., Huang, J.-F. & Chang, Y.-S. (2018e) The congrid eel genus *Ariosoma* in Taiwan (Anguilliformes: Congridae), with description of a new species. *Zootaxa*, 4454 (1), 84–106.
<https://doi.org/10.11646/zootaxa.4454.1.10>
- Tighe, K.A., Ho, H.-C. & Hatoooka, K. (2018) A new species of the genus *Dysommia* (Teleostei: Anguilliformes: Synphobranchidae: Ilyophinae) from the Western Pacific. *Zootaxa*, 4454 (1), 43–51.
<https://doi.org/10.11646/zootaxa.4454.1.6>
- Weber, M. & de Beaufort, L.F. (1916) *The Fishes of the Indo-Australian Archipelago. III. Ostariophysi: II Cyprinoidea, Apodes, Synbranchi*. E. J. Brill, Leiden, 3, pp. 1–455.